

Journals.

Canadian Record of Science. Vol. IV. No. 2. 8vo. *Montreal*
1890. Natural History Society, *Montreal*.

Nature Notes. No. 5. 8vo. *London* 1890.

The Editors.

Revista do Observatorio. Anno V. No. 4. 8vo. *Rio de Janeiro*
1890. The Observatory.

Revue Médico-Pharmaceutique. Année 3. No. 4. 4to. *Con-*
stantinople 1890. The Editor.

Stazioni Sperimentali Agrarie Italiane. Vol. XVIII. Fasc. 4.
8vo. *Asti* 1890. R. Stazione Enologica, *Asti*.

Thirty-six *Carte de Visite* Photographs of Fellows of the Royal
Society. Messrs. Maull and Fox.

June 12, 1890.

Sir G. GABRIEL STOKES, Bart., President, in the Chair.

Sir Benjamin Baker, Mr. R. H. M. Bosanquet, Mr. S. H. Burbury,
Mr. W. Gardiner, Dr. A. S. Lea, Major P. A. MacMahon, Professor
S. U. Pickering, Mr. I. Roberts, Mr. J. J. H. Teall, and Dr. R. T.
Thorne were admitted into the Society.

The Presents received were laid on the table, and thanks ordered
for them.

The following Papers were read :—

- I. "On a Re-determination of the principal Line in the Spec-
trum of the Nebula in Orion, and on the Character of the
Line." By WILLIAM HUGGINS, D.C.L., LL.D., F.R.S., and
Mrs. HUGGINS. Received March 20, 1890.

[Publication deferred.]

- II. "Note on the Photographic Spectrum of the Great Nebula
in Orion." By WILLIAM HUGGINS, D.C.L., LL.D., F.R.S.,
and Mrs. HUGGINS. Received April 16, 1890.

[Publication deferred.]

- III. "On a new Group of Lines in the Photographic Spectrum of Sirius." By WILLIAM HUGGINS, D.C.L., LL.D., F.R.S., and Mrs. HUGGINS. Received April 25, 1890.

[Publication deferred.]

- IV. "Preliminary Note on the Development of the Tuatara (*Sphenodon punctatum*)." By Professor A. P. W. THOMAS, M.A., F.L.S., F.G.S., University College, Auckland, N.Z. Communicated by Professor E. RAY LANKESTER, F.R.S. Received May 19, 1890.

A grant was made by the Royal Society in the year 1884 to Professor J. T. Parker, of Dunedin, for the study of the development of *Apteryx*, *Sphenodon* and *Callorhynchus*. As *Sphenodon* does not occur near Dunedin, but is found chiefly on outlying islands belonging to the province of Auckland, at the opposite end of the colony, Professor Parker invited me to join him in the investigation of this form.

We gathered from what had been written on the natural history of the tuatara, as well as from oral information obtained from those who were best acquainted with the New Zealand fauna, that the month of February was probably the time at which the tuatara bred.

We therefore started from Auckland at the beginning of February, 1885, for what appeared the most promising hunting-ground—the island of Karewa, some ten miles from Tamanga, in the Bay of Plenty. Mr. A. Reischek, a naturalist well known by his researches on the natural history of New Zealand, who had already had opportunities of observing the tuatara, was good enough to accompany us.

The island of Karewa is situated some four miles from the mainland; it is little more than a rock which rises with precipitous sides high above the sea. At one spot only can a landing be effected, as the island is exposed to the ocean swell rolling in from the open Pacific, whilst the shores are for the greater part formed by unscalable cliffs of rhyolitic rock. Our first attempt at landing was frustrated by the swell, but a day later a second attempt was successful.

The vegetation on the island is largely composed of small karaka trees and thickets of coprosma. The light, loose soil between the roots of trees and the rocks is mined by countless burrows, in which live mutton-birds (*Puffinus tenuirostris*) and tuataras.

On the "Chicken Islands" the tuataras have been described by Mr. Reischek as living with certain other sea-birds, namely, another

species of *Puffinus* (*P. gavius*) and two species of *Procellaria*. This has been cited in 'Nature'* as an interesting case of commensalism, and it is there stated that the birds "live in holes dug out by the tuataras and keep apparently on the best terms with them." It is stated that the tuatara generally lives on the right and the sea-bird on the left of the inner chamber.

I believe it is quite a mistake to suppose that any friendly relation whatever exists between the tuataras and the birds, and that here, as in the somewhat similar case of the prairie dog and rattlesnake, the idea of friendliness is quite out of place. It is true that the tuatara sometimes makes use of the burrows of the mutton-bird (though I have never found a tuatara living in the same burrow as a mutton-bird), but it cannot be said that the two species ever live on more favourable terms than those of mutual toleration. At one time I kept two kiwis in a large house with a number of tuataras, and a tuatara would at times shelter itself in the same box or corner as a kiwi—the two never attempting to fight, the tuatara hiding itself under the kiwi as it would do under a stone, whilst the kiwi seemed not to notice its presence. The tuatara seems to enter the burrow of the mutton-bird just as it would shelter itself in any other hole in the ground.

In any case, the tuatara must be an untrustworthy associate, for on four occasions I have seen or captured tuataras with young mutton-birds in their mouths. It is probably a truer view of the situation to suppose that the chance of getting a nestling renders the burrows of the mutton-bird more attractive to the tuatara.

Dr. Günther, in the absence of personal observation, supposed that the tuatara was incapable of burrowing. It is, however, certain that it can burrow well in such light soil as is found on Karewa, and even in the clay soil on which my lizard-houses are situated the animals have made burrows fully two feet in length, in which they are completely hidden. Not all the lizards, however, are so industrious; most of them have contented themselves with the artificial burrows, in the shape of long wooden boxes and drain pipes, with which they have been provided.

We spent some days camping on the island and captured a number of tuataras, but searched in vain for eggs, though we opened up many burrows in the hope of finding them. The smallest tuatara found was 4·9 inches in length. Not finding eggs, we dissected several tuataras, thinking that the condition of the ovaries might tell us whether we were too early or too late in the breeding season, but the dissection revealed no eggs at all approaching maturity.

We took away from the island a number of tuataras, hoping that

* October 19, 1882. See also 'Transactions of the New Zealand Institute,' vol. 14, p. 274.

they would breed in captivity. Some of these were taken by Professor Parker to Dunedin, a rather larger number being kept by me in Auckland, as it was thought that the warmer climate of the northern part of the colony would be more favourable.

Up to the beginning of January, 1886, no eggs had been obtained from my tuataras, and, as regards the lizards I then possessed, any such hope was futile, for I shortly afterwards discovered that all my tuataras (twenty-nine in number) were males. Thinking that our visit the previous summer had been too late in the season, I determined to make another expedition to Karewa, this time at my own expense. Professor Parker was unable to join me, owing to the great distance of Dunedin from the spot; he was, moreover, engaged in working at the development of the kiwi. From this date, therefore, the whole of the work fell into my hands. I spent three or four days at the beginning of January in camp alone on Karewa; but, although a month earlier in the season than on the occasion of the previous visit, I was again unsuccessful in procuring a single egg of the tuatara.

I made, however, a step in advance by discovering the external differences between the sexes. We had been assured by those familiar with the tuatara that there was no difference in the external characters of the sexes, and this statement seemed to be borne out by what we could learn from the literature of the subject. Thus, Dr. Newman, the latest writer on the subject, said*: "The males are so like the females that they have not yet been distinguished with certainty."

"The male tuatara has no special strongly marked tints, no special personal attraction; and, unlike the males of several other species of lizards, are not much, if at all, bigger than the females. The absence of special sexual attributes is perhaps due . . ."

On dissecting and carefully comparing a number of tuataras, I found that the current statements were not correct. There need seldom be any difficulty in distinguishing the sexes; the male is much larger, and has the crests on neck and back far more strongly developed. In the fully adult male, the crests with their white spines are very conspicuous; in the female, the crests are low, and the spines are reduced to a row of white points along the back. The male, too, is of more robust build, its coloration is somewhat brighter, and it is more pugnacious. During the breeding season the crests in the male become at times turgid and swollen, the spines standing stiffly up, and giving the animal a much more antique and grotesque appearance. It must be noted, however, that a good deal of variation occurs in both the tints and brightness of colour in both sexes, and the spines are larger in some females than in others.

The discovery of the external characters of the sexes showed me

* 'Transactions New Zealand Institute,' vol. 10, p. 225.

that all the tuataras I had kept for the past year (twenty-nine in number) were males. This arose chiefly from the fact that males are more easily obtained than females; but it is possible that our desire to obtain the largest, most vigorous, and fully adult animals for breeding accounts in part for our having retained only males for breeding purposes.

On the occasion of this second visit I secured as many females as I could, but found more difficulty in obtaining females than males, so that I set a number of males at liberty as being superfluous. The apparently greater abundance of the males is perhaps due to the females seeking concealment more than the other sex; at any rate, I am led to suggest this from the observation of my tuataras kept in confinement. The instinct of concealment would, of course, be of special value to a female laden with eggs.

Notwithstanding that I now possessed a dozen pairs of tuataras, no eggs were obtained the following summer. The lizards had been kept in large houses and were well cared for, and appeared in good health, but would not breed. Captivity would seem to interfere with their reproductive powers, an effect which would hardly be anticipated with animals of so sluggish a nature.

I could only refer their sterility in confinement to a change in some of the conditions of life consequent on captivity, and endeavouring, therefore, to make their surroundings approximate more closely to the natural ones, I had still larger houses constructed, and extensive runs on the open ground enclosed.

It was not, however, till January, 1889, that eggs were obtained, and even then some of them were infertile. Weary of the constant watching of the lizards in previous summers, I took a short holiday at the New Year, and during an absence of five or six days a female lizard died, but was not noticed by the attendant in charge. On my return I found that it had contained twelve fully formed eggs; they had, however, begun to putrefy. A second female laid ten eggs, which proved infertile. A third, which promised well, died from inability to lay its eggs. It was closely watched, and dissected within an hour of its death. The oviducts contained four and five eggs respectively, fully formed and ready for laying. From these eggs were obtained a number of embryos at various stages of development, from a stage equal to a two days' chick up to a stage shortly before hatching. This year I hoped to obtain a further supply of embryos, but only one female has laid, and her eggs were infertile.

The eggs of the tuatara are oval in form, both ends being of equal diameter, and vary in length from 2.5 to 3.35 cm. The egg-shell is probably much like that of other oviparous lizards, being tough, flexible, and very elastic; it contains a varying amount of carbonate of lime. The eggs dry and shrivel with great readiness when exposed to the

air, and must, therefore, be kept in damp surroundings. On the other hand, excess of moisture encourages the growth of micro-organisms in the mucus with which the eggs are frequently covered when laid, and such foreign growths tend to the destruction of the contents.

On the whole, the general features of the development are closely similar to those in other lizards; I propose, therefore, to reserve the details until a complete account can be given. I may, however, mention that the pineal eye becomes a prominent feature at an early stage. When pigment is deposited in the skin, an oval spot is left free from it over the eye, and through this the dark pigment of the retina shows clearly. Spencer* has stated that there is in *Sphenodon* very little external trace of the pineal eye. This is true of the adult, but in the recently hatched tuatara the pineal eye still shows as a dark spot through the translucent skin over the parietal foramen. This I have been able to observe even in a tuatara 8 inches in length. But as the tuatara grows older the skin over the pineal eye becomes more opaque, and though in some individuals the scantier development of the pigment over the parietal foramen affords a feeble indication of the position of the eye, yet in others the pigment is deposited there as elsewhere, so that all external trace of the eye is finally lost.

V. "On the Position of the Vocal Cords in Quiet Respiration of Man, and on the Reflex-Tonus of their Abductor Muscles." By FELIX SEMON, M.D., F.R.C.P., Assistant Physician in charge of the Throat Department of St. Thomas's Hospital, and Laryngologist to the National Hospital for Epilepsy and Paralysis, Queen Square. Communicated by Professor VICTOR HORSLEY, F.R.S. Received May 25, 1890.

(Abstract.)

The investigation which forms the subject of this paper was undertaken with a view of settling, if possible, the moot question whether in man the larynx during quiet respiration plays an active rôle or not, and, if the former, what is its function?

For this purpose the author has examined, by means of graduated mirrors, the size of the glottis during quiet respiration in fifty adult trained healthy persons, and, after death, in twenty-five adult bodies. The method of the examination and the precautions necessary to guard against possible fallacies are fully described in the paper. A comparison of the measurements thus obtained shows that in less than 20 per cent. the vocal cords during quiet respiration perform

* 'Quart. Journ. Microsc. Science,' vol. 27, p. 176.